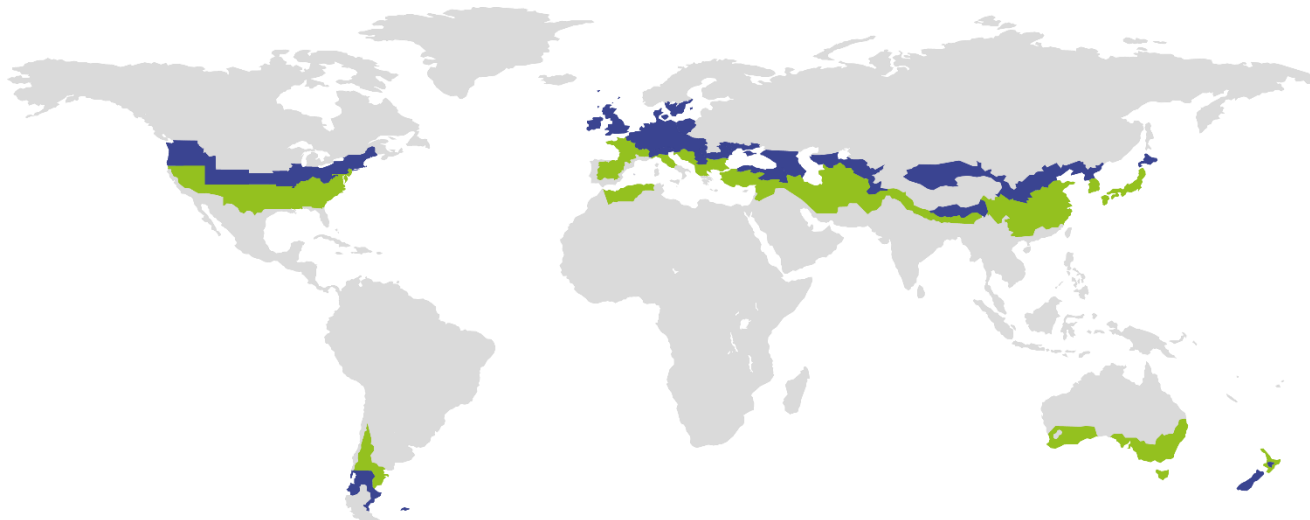


# CERTIFICATE

Certified Passive House Component

Valid until 31st December 2020

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Category: **Air handling unit with heat recovery**  
Manufacturer: **Menerga GmbH**  
**Germany**  
Product name: **Ventilation unit series**  
**Resolair 64 05 01 – 64 32 01**

Specification: Airflow rate > 600 m<sup>3</sup>/h  
Heat exchanger: Regenerative

**This certificate was awarded based on the product meeting the following main criteria**

Heat recovery rate	$\eta_{HR}$	$\geq$	75 %
Specific electric power	$P_{el,spec}$	$\leq$	0.45 Wh/m <sup>3</sup>
Leakage		$<$	3 % <sup>2)</sup>
Performance number		$\geq$	10
Comfort			Supply air temperature $\geq$ 16.5 °C at outdoor air temperature of -10 °C

<b>Airflow range</b>
1000-15000 m <sup>3</sup> /h at an external pressure of 265-390 Pa <sup>1)</sup> Requirements non-residential buildings (Therefore also applic- able for residential buildings)
<b>Heat recovery rate</b>
$\eta_{HR} \geq 86 \%$
<b>Specific electric power</b>
$P_{el,spec} \leq 0.45 \text{ Wh/m}^3$
<b>Performance number</b>
10

<sup>1)</sup> The pressure drop of filters is covered in the listed external pressure. Additional components (e.g. heating coil) decrease the available external pressure accordingly.

<sup>2)</sup> It must be taken into account that in this regenerative heat recovery system an exhaust air transfer of more than 3 % of exhaust airflow volume occurs. The use of exhaust air from rooms with a high degree of contamination must therefore be examined project-specific.



Component ID	Unit model	Testing requirements	Airflow range		External pressure Pa	Actual available external pressure <sup>1)</sup> Pa	Specific electric power Wh/m <sup>3</sup>	Heat recovery rate %	Performance number -
			Min m <sup>3</sup> /h	Max m <sup>3</sup> /h					
0854vl03	640501	Non-residential	1000	3000	290	254	0.44	86	10
0591vl03	640701	Non-residential	1500	4500	316	281	0.45	86	10
0855vl03	641001	Non-residential	2000	6000	333	299	0.44	86	10
0856vl03	641201	Non-residential	3000	7000	3463	310	0.44	86	10
0857vl03	641501	Non-residential	3200	8800	359	325	0.43	87	10
0858vl03	642101	Non-residential	5000	11000	371	340	0.45	88	10
0859vl03	642601	Non-residential	7000	13000	381	352	0.45	87	10
0860vl03	643201	Non-residential	9000	15000	390	362	0.44	87	10

Table 1: Certified values for each unit model. <sup>1)</sup> Pressure drop of filters were taken into account.

### Passive House comfort criterion

A supply air temperature of 16.5 °C is maintained at an outdoor air temperature of about -10.0 °C.

### Efficiency criterion (heat recovery rate)

The effective heat recovery rate is measured at a test facility using balanced mass flows of the outdoor and exhaust air. The boundary conditions for the measurement are documented in the testing procedure.

$$\eta_{HR} = \frac{(\theta_{ETA} - \theta_{EHA}) + \frac{P_{el}}{\dot{m} \cdot c_p}}{(\theta_{ETA} - \theta_{ODA})}$$

With

- $\eta_{HR}$  Heat recovery rate in %
- $\theta_{ETA}$  Extract air temperature in °C
- $\theta_{EHA}$  Exhaust air temperature in °C
- $\theta_{ODA}$  Outdoor air temperature in °C
- $P_{el}$  Electric power in W
- $\dot{m}$  Mass flow in kg/h
- $c_p$  Specific heat capacity in Wh/(kg.K)

- The heat recovery rates for each model of the unit are listed in Table 1.

## Airflow range and external pressure difference

The operational range of the device results from the efficiency criterion (see below). As per the certification criteria for ventilation units > 600 m<sup>3</sup>/h the applicable pressure differences vary with the nominal range of operation (as declared by the producer) and the application (residential or non-residential building).

The external pressure difference includes all pressure losses of the ventilation system caused by components apart from the tested unit (consisting of casing, heat exchanger and fans). If filters are installed inside of the unit, their pressure losses are to be reduced accordingly. The average filter pressure drop of an operational filter is assumed to be 30% higher than that of the clean filter.

- The airflow ranges and available external pressures for each model of the unit are listed in Table 1.

## Efficiency criterion (electric power)

The overall electrical power consumption of the device including controllers was measured at the test facility as per the requirements for non-residential buildings at an external pressure difference of 265-390 Pa.

- The specific electric powers for each model of the unit are listed in Table 1.

## Performance number

Based on the measured values for the calculation of heat recovery efficiency and power consumption and on the climatic data of central Europe (Gt: 84 kWh, heating time: 5400 h/a), an average performance number at the airflow range was determined.

- The performance numbers for each model of the unit are listed in Table 1.

## Leakage

The airtightness of the unit is tested for under pressure and over pressure before the thermodynamic test is conducted. As per the certification criteria the leakage airflows must not exceed 3 % of the average airflow of the device's operating range.

Exhaust air transfer	External leakage
6.6 % <sup>1)</sup>	< 0.8 %

<sup>1)</sup> Exemplarily measured at the unit type 64 15 01 at an airflow volume of 8820 m<sup>3</sup>/h

- These appliances meet the external leakage requirement. Exhaust air transfer of more than 3 % of the exhaust airflow volume occurs. The use of exhaust air from rooms with a high degree of contamination must therefore be examined project-specific.

## Settings and airflow balance

It must be possible to adjust the balance of airflows at the unit itself (either between the exhaust and the outdoor airflows or between the supply and the extract airflows, if the unit is respectively placed inside or outside of the insulated thermal envelope of the building). Available operation modes are explained in detail in the operation manual.

- Balancing of the airflow rates of the unit is possible.
  - ✓ The airflow volumes can be held steady automatically (by measurement of pressure differences at the fan inlet nozzle).

- The standby power consumption of these devices makes 45 W. The target value of 1 W was exceeded. The device should be equipped with an additional external switch so that it can be disconnected from the mains, if required.
- After a power failure, the device will automatically resume operation.

## Acoustical testing

A ventilation unit > 600 m<sup>3</sup>/h is assumed to be operated in an installation room, for which sound limits are defined in the applicable regulations. The total acoustic power levels were determined by producer for each model of the units at an upper limit of the airflow range.

Unit model	Testing requirements	Airflow range		Total acoustic power level				
		Min	Max	Casing	Duct			
		m <sup>3</sup> /h	m <sup>3</sup> /h		ODA	SUP	ETA	EHA
				dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
640501	Non-residential	1000	3000	55	65	79	73	71
640701	Non-residential	1500	4500	62	72	85	80	79
641001	Non-residential	2000	6000	63	63	83	65	79
641201	Non-residential	3000	7000	59	67	81	76	74
641501	Non-residential	3200	8800	60	71	84	84	77
642101	Non-residential	5000	11000	59	67	82	76	74
642601	Non-residential	7000	13000	64	73	85	85	78
643201	Non-residential	9000	15000	64	73	86	85	78

Tabele 2: Acoustic power levels at an upper limit of the airflow range.

- For complying with the required sound level in the supply air and extract air rooms, dimensioning of a suitable silencer is required for the specific project on the basis of the measured sound level.

## Indoor air quality

Instructions for changing of the air filters are documented in the operation manual. This device is equipped with following filter qualities:

Outdoor air filter	Extract air filter
F7	M5

If the device is not operated during summer, the filter should be replaced before the next operation. The producer of the device has to ensure that based on the latest findings, room air hygiene can be maintained by means of integrated or obligatory components.

For the operation of ventilation systems a strategy for avoiding permanent moisture penetration of the outdoor air filter needs to be considered. The strategies are mentioned in the full report and can be implemented through installation of either an additional component of the ventilation device or on the ventilation site system.

## **Frost protection**

Appropriate measures should be taken to prevent the heat exchanger and optional downstream hydraulic heater coil from getting damaged by frost during extreme winter temperatures ( $-15\text{ }^{\circ}\text{C}$ ). It must be ensured that the unit's ventilation performance is not affected during frost protection cycles.

- Frost protection of the heat exchanger:
  - ✓ The regenerative heat recovery system ensures a transmission of condensing humidity (when temperature falls below the dew point) from the exhaust/extract airflow to the outside/supply airflow. Due to his humidity recovery the formation of excess condensate is avoided. A freezing of the heat recovery system is avoided for this reason the use in comfort air conditioning. No active frost protection circuit is required to ensure frost protection for the heat recovery system without interruption of fresh air.

## **Bypass of the heat recovery**

The heat recovery system uses two stationary heat storage masses which, controlled by a damper system, are alternately flowed through by warm extract air and cold outside air. By extending the time interval of switching of the damper system, the heat recovery rate can be reduced. If no switching takes place, no heat is recovered. The suitability for free night cooling was not analysed within the scope of these tests.